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PHARMACY
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American Association of
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Discover • Learn • Care: Improve Health
INTEGRATION OF BIOLOGICAL SCIENCES
PHARMACY EDUCATION

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OUTLINE

• DEFINITIONS

• WHY & HOW?
  – STRATEGIES/MODELS FOR INTEGRATION

• BARRIERS

• EXAMPLES

• SUMMARY
DEFINITIONS

• Making connections across the whole curriculum
  – knowledge-based; skill-based; real-life based

• Goal:
  – *Curriculum*: Provide a holistic view of learning; Break barriers between subjects; Prevent labeling of knowledge. Responsible curriculum.
  – *Learner*: Provide rigor and relevance; Encourage engagement; Challenging; Responsibility for learning.
  – *Faculty*: become a facilitator/coach; Build respect and appreciation for the contribution of other disciplines; Embracing of a new culture.
<table>
<thead>
<tr>
<th>EXAMPLES INTEGRAED CURRICULUM</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>Multidisciplinary</td>
<td>Focus is on the disciplines (e.g. biochem, physiology, anatomy and pharmacology, medicinal chemistry, therapeutics and a theme such as pharmacodynamics, patient safety or communication skills or a specific educational outcome (critical thinking)). (examples: Fusion, Intra-disciplinary, Service Learning)</td>
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<tr>
<td>Interdisciplinary</td>
<td>Organized around common learning across disciplines. Drug metabolism; dispensing a prescription with Jurisprudence and communication to emphasize interdisciplinary skills and concepts</td>
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<tr>
<td>Trans-disciplinary</td>
<td>Organized around student questions and concerns. Project based learning and Negotiating the Curriculum</td>
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WHY

• Constructivism theory
• Era of accountability
• ACPE standard 10

The college or school’s faculty must be responsible for development, organization, delivery, and improvement of the curriculum. The curriculum must define the expected outcomes and be developed, with attention to sequence and integration of content and the selection of teaching and learning methods and assessments. All curriculum pathways must have both required and elective content and experiences and must effectively facilitate student development and achievement of the professional competencies.
WHY

• Perceived Benefits:
  – Increased motivation and learning
  – Encourage depth and breadth of learning
  – Enhance critical thinking and intellectual curiosity
  – Enhance problem solving skills
  – Increase relevance
  – Simulate real life
  – Help students apply skills
  – Promote communications among faculty
  – Increased curriculum efficiency, decrease redundancy
  – Too much work upfront but more rewards in the long
• Self Driven
  – The spectrum from:
    • identifying pre-requisites,
    • reinforcement of prior concepts,
    • finding the clinical relevance,
    • revisiting science, administrative, law principles,
    • providing interactive lectures based on different disciplines but a common theme (multidisciplinary);
    • inviting other faculty members to contribute (interdisciplinary);
    • consorted effort with purposeful communication with other faculty
• ------> the Scholarship of Teaching and Learning
- **Programmatic**
  - **Entire Curriculum:**
    - Course sequencing;
    - Co-requisite courses supported by schedule (synchronization);
    - Based on educational outcomes/core competencies:
      - IRd/D model; (Content organization)
      - Spiral Model;
      - Integration of content horizontally/vertically;
      - Interdisciplinary teams; scaffolded instruction
HOW

• Programmatic
  – Courses/activities: fusion of two or more course; Programmatic OSCEs, Case-based, capstone course, Skills lab activities, experiential experiences, service activities, immersion experiences.
  – Use of technology: Electronic integration; computer cases.
  – Liaison program
  – Comprehensive assessment (skills lab, capstone exams)
  – Administrative: remove departments, integrate departments and faculty

• Motto: *I teach in our curriculum*
HOW? Self Driven: ELECTRONIC INTEGRATION

• Alsharif NZ and Henriksen B. Electronic Integration of Prerequisite Course Content. Am J Pharm Educ. 2009;73(8):Article 44.

• Demonstration
HOW? PROGRAMMATIC: BIOMEDICAL SCIENCE COURSE LIAISON PROGRAM

To facilitate communications between pharmacy and medicine faculty colleagues who instruct pharmacy students in required basic science courses.
RESPONSIBILITIES OF THE LIA

- Regular communications with the instructor of record about course content, structure, examinations schedule, etc.
- Attending classes as appropriate, particularly when issues of concern are identified by the students or fellow faculty members
- Providing an “expert” opinion regarding course content and structure to balance student perspective
- Reporting to appropriate curriculum committees when issues of concern arise
- Provide a written summary report of the course at the end of the semester
GOALS FOR PHARMACY STUDENTS

• Develop an appreciation for original discovery

• Reinforce the importance and relevance of the content of biomedicine courses to the students’ future practice
THE CELL

• Cell Membrane (DRUG PHARMACOKINETICS)
  – Drugs require both lipophilic nature to allow penetration inside the lipid bilayer and hydrophobic nature to allow exit out of membrane.
  – Highly lipophilic drugs are extracted by the liver and metabolized; highly polar drugs are excreted by the kidney.
  – Drugs that act on the CNS, must have good lipophilic nature to allow penetration of the blood brain barrier.
THE CELL

• Endoplasmic reticulum (DRUG METABOLISM)
  – The microsome contains the enzymes that are the site of metabolism and the liver is the major site of drug metabolism.
  – Drugs are usually oxidized, reduced or hydrolyzed and converted to water soluble species to be excreted by the kidney.
  – Patients with liver disease, infants and the elderly may have decreased liver activity and as a result drugs may accumulate and result in toxic effects if the dose is not decreased.
  – Some drugs inhibit (e.g. cimetidine) the function of the metabolizing enzymes which again can result in accumulation of ingested drugs metabolized by the liver.
• L-histidine (Antihistamine Drugs)
  – It forms histamine in the body which results in constriction of smooth muscles (H₁-receptor) and stimulation of gastric secretion (H₂-receptor).
  – Drugs are synthesized to antagonize the effect of histamine on these receptors:
    • Astemizole, Azatadine, Diphenhydramine (act on H₁-receptors) ---------> used for treatment of allergic rhinitis, urticaria, allergic anaphylactic reactions
    • Zantac (Ranitidine), Famotidine, cimetidine (act on H₂-receptors) ------------> used for treatment of duodenal and gastric ulcers
AMINO ACIDS

• **L-Tryptophan**
  – Important in the synthesis of important neurotransmitters (e.g. serotonin, norepinephrine, and epinephrine).
  – Drugs can either mimic the action of neurotransmitters or antagonize such actions.

• **Gamma-aminobutyric acid (GABA)**
  – Inhibitor of neurotransmission in the CNS. Barbiturates (e.g. phenobarbital) and benzodiazepines (e.g. Valium (diazepam)) potentiate its effect and result in a sedative, hypnotic, relaxant effect.
BARRIERS

• WHAT ARE THE BARRIERS?
WHAT IS NEEDED FOR INTEGRATION

• Buy in; Enculturation of all faculty.
• Availability of resources
  – Faculty, staff and administrators development activities
• Active and proactive involvement of the curriculum and assessment committee
• Active and proactive involvement of academic affairs (e.g. schedules)
• Purposeful and efficient rather than redundant repetition (link to educational outcomes)
• Start small and celebrate successes
• Ensure communications among faculty
• Emphasis should be bidirectional (science, social and administratively sciences with clinical and vice versa)
• It is critical to assess, re-evaluate, modify, re-assess, re-evaluate, re-evaluate...
  – The key is: _____________
PHARMACY EXAMPLES

• Programmatic

• Exercises
• Courses

• Analogies
  – Alsharif, NZ. Rationale drug design and food analogy demonstration.
• **Skills Lab**  

• **Use of technology**  
  – Alsharif NZ and Henriksen B. *Electronic Integration of Prerequisite Course Content*. Am J Pharm Educ. 2009;73(8):Article 44.  

• **Viewpoints**  
SUMMARY

• Pharmacy is considered by many as a science-based practice

• Evidence based medicine is key to pharmacy practice and depends on the rigorous use of scientific methodology to make therapeutic decisions

• Basic and biological sciences are at the heart of evidence based medicine and should be integrated throughout the curriculum
REFERENCES

GENERAL


